

*This document contains two documents written in 1956 and 1957 by John Davy (1927-1984) on evolutionary theory; specifically how current scientific theory and Steiner's teachings compare.*

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See also the book: "Hope, Evolution, and Change" containing 27 essays by John Davy

## **Evolution: The Hidden Thread**

**by John Davy**

This article was first published in "The Golden Blade", London, 1956.

Anyone who studies Rudolf Steiner's teachings will soon realise that the descriptions he gives of the way man has evolved are not easy to reconcile with the descriptions given by modern science. The purpose of this article is to try and indicate how some of the difficulties may be resolved.

When Darwin was born, the idea of evolution was already percolating, so to speak, into men's minds. Darwin's great achievement was to put forward a theory to explain evolution, and to collect a vast number of facts to back it up. He suggested that evolution could be brought about by 'natural selection'. That is, any variations in the 'normal' displayed by an animal would confer on it either advantage or a disadvantage in the 'struggle for existence'. Animals with advantageous variations would be more likely to survive and to pass on their advantages to their offspring. They would, in other words, be 'selected', and an accumulation of such advantageous characters, in the course of generations, would, Darwin supposed, eventually produce new species.

In Darwin's day, very little was known about the 'fossil record', and Darwin thought that the present-day higher animals must have descended from animals very like the present-day lower ones. As paleontology developed, however, it became clear that in the past any kinds of animals, now extinct, had flourished. Also, the fossil record seemed to confirm Darwin's suggestion, which caused such a furor at the time, that man is descended from the higher animals - for if the fossil record is traced back a point is reached where human remains no longer appear, while further back still there are no mammal, no reptile, no amphibian, and finally no fish remains.

### **Genetics**

Towards the end of the nineteenth century the work of Mendel was rediscovered, and the science of genetics began to develop. It became clear that variations could arise from genetic mutations - changes in the 'genes' which are regarded as the bearers of inherited characteristics - and that these variations could be handed on intact to the descendants. For some years genetical theory proved not altogether easy to reconcile with the idea of gradual evolutionary change caused by natural selection. In 1930, however, R.A. Fisher published *The Genetical Theory of Natural Selection*. In its way, this book was almost as much of a milestone as Darwin's *Origin of Species*. Fisher showed how apparently insignificant mutations could confer a selective advantage if the 'selection pressure', even though very slight indeed, continued over long stretches of geological time. (Selection pressure is the term used to describe the 'pressure' of the environment on the animal which produces natural selection). Such apparently insignificant selective advantages, he showed, were sufficient to account for the formation of new species, for the development of new sub-groups, and even for the most improbable adaptations such as are described in every 'wonders of nature' book.

Fisher's work, which in recent years has been much supported and extended in great detail by such scientists as H.J. Muller, B.S. Haldane and Sewall Wright, involves a lot of difficult statistical mathematics. Indeed, the whole of modern genetical theory is so complex that it cannot be discussed here. Three points will be enough.

First, Fisher describes natural selection as 'a mechanism for generating an exceedingly high degree of improbability'. His theory thus effectively undermines the empirical argument that the odds against evolution having occurred 'by chance' are almost inconceivably great.

Second, present-day ideas about the scale of geological time give ample scope for the slow speed of evolution demanded by Fisher's theory.

Finally, it is worth remembering that while the theory is extremely consistent and convincing - it has certainly convinced over 99% of the biologists who have studied it - it is, and must remain a theory. Like a newly invented kind of mathematics, it could correspond to a reality, but it need not if there seems to be sufficient reason to look for an alternative.

The modern theory of evolution is thus a formidable and coherent structure, which is being continually backed up by work in many branches of science. Nevertheless, some of the adaptations and patterns of behaviour found in the animal kingdom are so extraordinary that non-scientists often feel that to explain their evolution merely through the action of natural selection on chance variations is far-fetched - and that there must therefore be something wrong with the theory. However, it is important to understand the scientist's attitude to this kind of objection. Hardly any scientists now doubt that modern evolutionary theory is broadly correct, and it would not normally occur to them to regard for instance, the social organisation of the ants or the extraordinary nest-building behaviour of many birds as a challenge to the theory. Rather, such phenomena are regarded as a challenge to the ingenuity of the biologist in thinking of a way in which such phenomena could have evolved gradually, through variation and selection during stretches of geological time measured in millions of years. Indeed, in more cases than the layman often realises, very plausible evolutionary schemes for many 'wonders of nature' have been worked out, and there seems to be a priori reason why similar schemes should not be worked out for others. The basic idea that even the most extraordinary specialised adaptations develop from an interaction between the organism and the environment is, I think fundamentally sound - although, as some modern work in genetics and embryology is beginning to indicate, the interaction may not be quite as simple as the classical Darwinian picture has it.

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At this stage, one might reasonably ask why, if the generally accepted theory of evolution appears so convincing and watertight, one should need to take account of Rudolf Steiner's differing views?

There are two reasons. The first is simply that there are, nevertheless, certain aspects of the modern theory which present some fundamental difficulties. But the second reason is more important.

Evolutionary theory is, in the last analysis, nothing more than a certain interpretation of the facts. With the help of Rudolf Steiner's work, one can interpret the same facts quite otherwise. Such an interpretation leaves room for man to be understood as something more than simply a higher animal, and for the evolutionary process to be understood as something more than the operation of chance. Let us now take a closer look at some of the facts.

The hardest facts, so to speak, of evolution, are the fossils of the fossil record. How are these fossils distributed through the strata? In the Paleozoic strata, for instance, fish and plant remains of all kind abound. Reptile remains are particularly abundant in the Mesozoic. Mammals dominate the Tertiary strata. But what is especially characteristic is that well-defined groups of animals tend to appear comparatively suddenly in the record, to flourish for a while, developing in the process all kinds of variations and specialisations of their basic form, and then to die out.

For instance, the reptiles which begin to appear in the fossil record at the beginning of the Mesozoic, gradually become very abundant, and a process called 'adaptive radiation' begins. That is, the 'basic' reptile type splits up into more specialised types adapted to particular modes of life - crawling reptiles, running reptiles, swimming reptiles, flying reptiles, carnivorous reptiles. It is as though all kinds of complicated variations on a theme were being elaborated. At the end of the Mesozoic virtually the whole vast and varied group dies out, and mammal fossils begin to appear, gradually becoming in their turn the dominant group. This process repeats itself, on a larger or smaller scale, throughout the fossil record.

Here we meet a real difficulty in modern evolutionary theory. The later representatives of most groups of animals in the fossil record are extremely specialised. On the other hand, the early representatives of a new group

are generally relatively unspecialised. It is very difficult to see how the specialised animals of one group could have given rise to the unspecialised animals of the next group up the evolutionary scale. What is more, even the unspecialised early representatives of a group often seem, on closer examination, to be already too specialised to be direct ancestors of a higher group.

### **Neoteny**

This is a very real problem, and modern biology is well aware of it. It is not simply that real fossil 'links' between most of the main groups of animals are lacking. A major obstacle is the difficulty of imagining how animals could get out of their specialised ruts, in order to give rise to higher animals. In a recent essay entitled *The Evolutionary Process* [ 1], Dr. Julian Huxley writes:

"Thus one result of specialised improvement is an eventual restriction of any further improvement. In addition, high specialisation for one mode of life restricts the possibilities of switching over to another . . . Specialisation thus almost invariably forces organisms into a deepening evolutionary groove out of which it is increasingly impossible for them to climb."

One interesting suggestion for avoiding this dilemma is elaborated in an essay in the same volume, called *Escape from Specialisation*, by A.C. Hardy. He summons to his aid a phenomenon called 'neoteny'. Neoteny is the process whereby a larval or embryonic form, which may itself undergo evolution and develop special features independent of the adult, becomes sexually mature and able to reproduce itself. The most often quoted example of neoteny is the Axolotl, which is found in Mexico, has external gills, and lives in the water. But it is also identical, except for its sexual maturity, with the larval stage of the North American Salamander, *Amblyostoma tigrinum*, which lives on dry land and breathes with its lungs. What is more, the Axolotl can be experimentally induced to postpone sexual maturity, develop further, and become a North American Salamander.

This phenomenon makes it possible to conceive of an animal escaping from a specialised groove by means of a pre-adult stage; during this it would develop certain evolutionary novelties and then, after becoming sexually mature through neoteny, it would give rise to a new race, less specialised, and with new opportunities for adaptive radiation.

Dr. Hardy ends his essay thus:

"However specialised a race of animals may have become in its typical adult condition, provided it has a less or differently specialised young or larval form (which naturally will be well-adapted to its particular way of living), and has a gene-complex which may sooner or later produce neoteny, then, given sufficient time, it stands a chance of escape from its path to extinction. In the great majority of stocks the end must come before this rare opportunity can intervene, but in a very small minority, the chances come earlier, before it is too late, and such lines are switched to new pathways, with fresh possibilities of adaptive radiation . . . Rare as they may be, these escapes from specialisation seem likely to have provided some of the more fundamental innovations in the course of evolution."

This picture of evolution is in many respects considerably different from Darwin's. The idea of natural selection, originally invoked as a process to explain the progressive evolution of more and more higher types of animals, now seems to be playing the opposite role of a process which tends to lead animals to extinction when they become too specialised. Invoking neoteny as a means of escape from this impasse makes it necessary to picture the actual ancestors of the major groups of animals, and presumably also of man, as having certain larval or embryo-like qualities.

Neoteny is thus now considered by many biologists to be the means by which evolutionary progress has ultimately been possible. But what is actually meant by 'evolutionary progress'? For many years science has been groping for a clear answer to this question. Do the terms 'higher' and 'lower', as applied to animals, really mean anything? Mere complexity is no final criterion - is a man more or less complex than a leopard or a beetle? There is no real answer.

Huxley, in the essay quoted above, considers this question, but reaches only a rather nebulous conclusion. "Biological progress," he says, "consists in biological improvements which permit or facilitate further improvements ... It is the process by which 'higher' types come into being, the process operating in the succession of dominant types, the process by which the upper level of improvement or biological achievement has been steadily raised during geological time."

## **Emancipation**

But there is a particular characteristic of 'biological progress' which has not yet been granted any fundamental evolutionary significance. This is that if, broadly speaking, the panorama of animals from the 'lowest' to the 'highest' types is considered, animals can be seen to have become progressively less dependent on their environment.

To take only the vertebrate group, the fish, for example, is dependent on a watery environment to bear it up, but reptiles and mammals can support themselves with their limbs by their own efforts. Reptiles' bodies, however, remain at much the same temperature as that of their environment, whereas mammals can maintain an even body temperature, independent, within certain limits, of the temperature of their surroundings. Young mammals develop, to begin with, inside the bodies of their parents, thus becoming independent of the external environment during their early stages.

This process can be followed through the animal kingdom, even into anatomical details where it is reflected as a kind of individualisation and consolidation of organs. Here, again, this process is evident even within the vertebrate group where the basic structure is relatively similar in the various types.

Compare the circulatory system of the fish with its mammalian counterpart, where the heart is divided into four chambers, and the circulation to the lungs is independent of the circulation to the body. The fish's head is fused to its trunk, whereas in higher animals the head has much greater independence of movement, and the jaw is an independent grinding apparatus instead of simply a kind of door into the mouth. The eyes of the fish are more or less static 'windows' - in the higher animals they are much more active and mobile. The fish's sense of hearing is spread out over its body in the lateral line system, and is barely distinguishable from a sense of touch or pressure. The bones of some of the gill arches of the fish are metamorphosed, in higher animals, into the icicles of the highly independent and specialised organ, the ear.

The final and most dramatic effect of this process is man's upright posture. In this way, head, arms and hands achieve a certain emancipation from the environment. They are not forced to function in such close connection with the earth as are the front legs and snouts of animals. The head can, as it were, sit back and think. The hands are freed from the limited function of helping to move the body from place to place.

### **A Counter-force**

There is a clear connection between the ideas of emancipation from the environment and of neoteny, in that neoteny produces an animal which is less specialised, and hence able to live in a more generalised environment. Both a neotenous and an 'emancipated' animal would be less dependent on a specialised environment for survival. The distinction between the two concepts is that while neoteny is assumed to have occurred repeatedly for many groups of animals, emancipation seems to have been a process operating steadily all the time. What the relationship between the two actually is will emerge in due course.

Emancipation clearly provides a kind of counter-force to natural selection. The tendency of natural selection is to edge the organism into an ever narrower and more specialised environment, to make it increasingly dependent on a special combination of external circumstances, to bind it more strongly to the earth. Emancipation works in the opposite direction.

Why, then, do adaptive radiation and specialisation play so important a role in modern evolutionary theory, while the polar concept of emancipation from the environment does not? There are two reasons. First, adaptation and selection can be observed actually happening - Darwin collected many examples - whereas emancipation, having occurred gradually throughout the course of evolution, is harder to define and identify. [ 2 ] Secondly, whereas a 'natural' explanation for adaptive radiation is available in the idea of natural selection, there is no really satisfactory corresponding explanation for emancipation. The tendency therefore is to assume that it has not really occurred, at any rate in any consistent way. But one can find an explanation in Rudolf Steiner's teachings.

It is curious that while science postulates all kind of unobservable entities to explain, in particular, atomic and sub-atomic phenomena, it shies away in alarm if asked to postulate supersensible spiritual entities to explain other phenomena. Yet Rudolf Steiner asks, to begin with, little more than science asks of itself - namely that his descriptions of events and beings in a spiritual world, not immediately accessible to the senses, should at first be neither accepted nor rejected, but tried out, by considering them side by side with natural phenomena to see if they

are mutually illuminating. Accordingly, if we are prepared to examine some of the things Rudolf Steiner says about the spiritual aspect of the evolution of the world and man, the phenomenon of emancipation begins to fall into place, and the fossil record, the concept of neoteny, and the relation of man to the animal kingdom appear in a new light.

### **Descent into Matter**

What distinguishes man from animals, Dr. Steiner says, is his possession of Ego. This is a spiritual entity, man's ultimate spiritual individuality, which lives in each human being. What we dimly experience as the central 'personality' of a person is the reflection of his Ego. In order to live on earth, the Ego must have a suitable physical vehicle - the human body. This vehicle had to develop gradually, over a long period of time. Evolution is really the story of the gradual descent of the Ego into matter, and of the gradual development of a physical body capable of containing it. The only physical form in which the Ego can express itself freely, into which it can descend completely, is the human form. What, therefore, is the connection between the animal forms preserved in the fossil record and the evolution of the human body? Modern science accepts that the majority of known fossils are already so specialised that they represent evolutionary dead-ends. At the origin of each major fossil group, therefore, an unspecialised neotenous form, which has left no fossil trace, has to be postulated.

This implies that neoteny must have occurred repeatedly - i.e., that each neotenous form is related to the next one up the scale only via a more specialised form which then at some stage undergoes neoteny. The problems involved in this rather unlikely sounding process disappear if we turn the whole concept the other way round. That is, we consider the series of unspecialised forms, (which science postulates but which do not appear in the fossil record), not as the outcome of repeated neoteny, but as a continuous evolutionary line, from which the specialised fossil groups have developed by branching off at various stages.

This raises a fresh difficulty - that in order to remain unspecialised, this 'embryonal' line must have somehow avoided being subject to 'selection pressure' from the environment. At the same time, it must have remained constantly subject to the emancipation process described above, since new specialised fossil groups appear at a higher stage of emancipation than their predecessors.

This difficulty is resolved if we recognise that this line of embryonal forms really represents the stages through which the human body has evolved. In the emancipation process, cosmic spiritual forces can be seen at work preparing a vehicle for the human Ego, the principle of independent individuality.

A more dynamic picture of evolution here begins to emerge, with the Ego principle gradually wresting a suitable physical vehicle from out of the grip of earthly forces. Neoteny is no longer required to account for the avoidance of specialisation, and indeed it is evident that science has introduced this concept largely in order to be able to explain the existence of an 'embryonal line' of evolution - which the fossil facts themselves demand - without having to admit into its picture of evolution any guiding process other than natural selection.

However, it is not easy to imagine this process of the gradual incarnation of the Ego clearly unless one associates with it a conception which modern science must inevitably find very hard to accept. All modern theories of evolution are based on the assumption that physical conditions in the past were essentially the same as they are now, and that physical laws known to be true now can be extrapolated backwards indefinitely. According to Rudolf Steiner, this is not so. Both physical substances and the laws which govern them, have themselves undergone evolution.

We must imagine, Dr. Steiner says, that before the beginning of the earth's evolution, substance itself existed in a purely spiritual condition. The first 'physical' manifestation was a kind of subtle interplay of states of warmth. Later, a gaseous, airy state was reached; then a vaporous, watery condition. Not until solid substance began to appear did geology begin, so to speak. But the particular characteristic of this process is that the earth must be imagined as a great living organism. All substance was more alive than it is today, and the 'dead' minerals we are now familiar with should be imagined as having been deposited gradually within the living earth, in the same sort of way that mineral bone is deposited in the developing embryo. When solid substance first appeared, says Dr. Steiner, it assumed horny, waxy, colloidal and jelly-like forms. .

This makes it easier to imagine the sort of conditions under which the 'embryonal line', the human body-form, must have developed. They must have been in a certain way similar to the conditions under which embryos develop today; in the embryo; even bone, the most mineral part of the adult organism, is alive and cartilagenous.

One can therefore picture the animal kingdom as having arisen through a kind of series of premature births of the living form which eventually developed into the present human body. An Ego which did not resist the pull of the physical forces of the earth for long enough, so to speak, would find its half-formed physical vehicle becoming bound too tightly to the physical environment, developing specialised forms and becoming irretrievably mineralised and rigid. Such an Ego would have lost the chance of fashioning a physical vehicle into which it could descend completely. The result would be an animal form.

Thus, when fossil fish appear in the fossil record, this is indeed a sign that the human germ was at that time passing through a 'fishlike' stage. But an idea of what this germ was actually like can be formed only by imagining what the embryo of the fossil fish must have been like. The adult is already too specialised and hardened in a particular direction.

### **Haeckel's Law**

Modern science has recognised this indirectly in the way it now interprets Haeckel's famous 'biogenetic law'. Haeckel suggested that 'ontogeny repeats phylogeny' - i.e. that in its embryological development an animal repeats, in a modified and condensed form, its evolutionary history. This used to be taken to mean that the fishlike stage in human embryology, for instance, when the embryo possesses gill-pouches, represents a 'repetition' of an adult fish ancestor. Modern embryology, however, has realised that this stage of the human embryo is really comparable only to an embryonic stage of a fish, not to the adult stage. In an excellent critique of the 'biogenetic law', Professor G. de Beer writes in this connection: 'All that can be said is that the fish preserves and elaborates its gill-slits, while reptiles, birds and mammals do not preserve them as such, but convert them into other structures such as the eustachian tube, tonsils, and the thymus glands.' [ 3 ]

However, in the light of Dr. Steiner's teachings we can take Haeckel's law almost literally. For the embryonic development of man really does reveal his evolutionary history much more accurately than does the line of fossil animals, for in it is reflected the 'embryonal line' of evolution which gave me to the animal fossils.

### **The Other Thread**

Seen in the light of Rudolf Steiner's teachings, therefore, it becomes clear that modern biology has so far confined itself to studying only one of the two threads of evolution - that thread which is visible in the process of adaptive radiation, and in the development of specialisations. The forces of the environment which give rise to natural selection, and the forces of genetics which bind the organism to the earth and maintain a physical continuity from generation to generation, represent forces of the earth. But modern evolutionary theory is coming to need more and more an understanding of the cosmic, heavenly, forces which have worked down into substance to fashion a vehicle for the Ego of man.

As it stands at present, the theory is really half a theory, since it can explain man only as the highest of the animals. Rudolf Steiner's work makes it possible to make the theory whole, and to begin to understand man as a being who is, at the same time, the 'lowest of the Angels'. Darwin's book, *The Descent of Man*, although what it is really concerned with is the ascent of man's body, is well-named, since the story of the evolution of man is the story of the descent of a spiritual being on to the earth. The animals represent beings which have descended too soon and too far - and perhaps the most tragic of all animals are the apes and monkeys, which descended just too soon to become men.

Among the multitude of spiritual beings which comprise the spiritual worlds, Rudolf Steiner sometimes described the human ego as a Spirit of Freedom. Man, he also once said, is not yet free, but he is on the way to freedom. The first task of the human Ego was to evolve a body in which freedom could be achieved - and this is what lies behind the process of emancipation, which from the physical point of view culminates in the form of the human body, as described earlier in this article.

It is interesting to find that modern biologists have realised something of the same kind - that man is in a unique position on the earth. He has reached a position in which he is not the passive subject of external forces, but in which he can take his future in his own hands, and mould his own environment. In the essay already cited, Julian Huxley writes:

'The present situation represents a ... highly remarkable point in the development of our planet - the critical point in which the evolutionary process, as now embodied in man, has for the first time become aware of itself ... and has a dawning realisation of the possibilities of its future guidance or control. In other words, evolution is on

the verge of becoming internalised, conscious, and self-directing.'

The 'highly remarkable point' mentioned by Huxley is surprisingly similar to that often described by Rudolf Steiner from many different points of view - namely, that the human Ego is now beginning to be able to exercise control over evolution, working in full consciousness within the body.

The future course of evolution will thus be directly affected by the ideas man holds about his own nature and about the evolutionary process. If he remains conscious only of one of the two threads of evolution, if he persists in seeing himself as primarily a higher animal, he will shape his life and his society accordingly. But if he allows his ideas to be fructified by Anthroposophy, so that he becomes conscious of the other, cosmic-spiritual aspect of evolution and of his own nature, he will understand that his task is to carry the spirit into matter and transform it.

## Footnotes

[1] Included in *Evolution as a Process*, a collection of essays by various authors (Allen & Unwin, 1954)

[2] Perhaps the best-known example of natural selection in action today is 'industrial melanism'. In the past hundred years, black or dark forms of several moths have spread and become increasingly common in manufacturing districts of England and Germany, while their 'normal' varieties have become increasingly rare. All these moths have a habit of settling on exposed places such as the trunks of trees, so that the dark varieties are almost invisible on the soot-blackened tree-trunks in industrial areas. Moreover, they appear also to be generally tougher and better able to survive the dirty air and vegetation of their environment. The detailed genetics of industrial melanism is still a subject of discussion and experiment by entomologists, but there is no doubt that its rapid spread is correlated with the blackening and pollution of the landscape. In country areas, the dark varieties are still fairly rare. See E.B. Ford, *Moths* (Collins, New Naturalist Series, 1955)

[3] *Embryos and Ancestors* (Oxford University Press, 1952)

# Epochs of Evolution

The previous article was devoted mostly to a discussion of modern 'neo-Darwinian' ideas about evolution and their relationship to the picture of evolution which emerges from the teachings of Rudolf Steiner. I tried to indicate how some of the apparent contradictions may be resolved, and to sketch briefly the kinds of evolutionary concepts which then emerge.

This article is intended as a sequel to the first, although it is written from a quite different point of view. Rudolf Steiner's account of the evolution of the earth and man includes many detailed descriptions of changing conditions of consciousness, of the activities of various spiritual beings, of the different relationships of the spiritual and physical members of man to each other during evolution, and so on. But he gives only the briefest indications of what the physical aspect of development was like, and only the sketchiest clues as to how the modern animals and the vast panorama of extinct fossil forms fit into the picture. To pursue this theme a little further is the purpose of the present article.

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Geologists divide the fossil-bearing rocks into three broad divisions, according to the nature of the fossils contained in them. The divisions are: Paleozoic - the rocks containing ancient forms of life; Mesozoic - 'middle life'; and Cenozoic - or rocks containing recent forms of life. Broadly speaking, remains of invertebrate animals and of primitive fishes dominate the Paleozoic strata; reptile remains dominate the Mesozoic strata; and mammal remains dominate the first part of the Cenozoic (the Tertiary strata). Not until the later Quaternary strata, after the great Ice Age, are fossil remains found of man as he is today.

The following very simplified table (to be read upwards) will summarise this:

	Quaternary.....	Man appears
Cenozoic		Ice Age
	Tertiary .....	'Age of Mammals'
	Cretaceous	
Mesozoic	Jurassic  .....	'Age of Reptiles'
	Triassic	
	Permian	
	Carboniferous	
Paleozoic	Devonian  .....	'Age of Fishes'
	Silurian	
	Ordovician	
	Cambrian	
	.....	
	Pre-Cambrian.....	No fossil remains



Between these main groups of animals, various other groups mediated. For instance, towards the end of the Paleozoic, especially during Carboniferous times, remains of all kinds of amphibian creatures, half-way between fish and reptile, abound. During the second half of the Mesozoic, and at the beginning of the Cenozoic, various 'mammal-like' reptiles, and curious primitive mammals are found. These geological epochs are relatively simple compared with the complicated series of evolutionary stages described by Rudolf Steiner, but it will be helpful to try to see how the two sequences are connected. In the first place, Dr. Steiner refers to three 'planetary incarnations' which preceded the present earth; he calls them 'Old Saturn', 'Old Sun' and 'Old Moon'. Between each of these incarnations, creation returned to a purely spiritual existence for a while.

The present solar system can be regarded as the fourth incarnation of the cosmic bodies which have evolved through these stages.

Man himself, and also the animals, plants and minerals, are not simply a product of evolution on this earth, but were involved in the earlier stages, too. Man's physical body, according to Rudolf Steiner, began its evolution on Old Saturn. His etheric body, which endows his physical substance with the capacity for growth and reproduction, began to evolve on Old Sun. His astral body, the bearer of feelings and passions, began its evolution on Old Moon. Man's individual spiritual core, his Ego, has only just begun its evolution, and the central significance of the present planetary incarnation - the Earth stage - is to allow the Ego to begin to transform the three older members of man so that it can come to full expression in them.

The minerals have only a physical body on earth, and are therefore at a stage comparable to the evolutionary stage of man on Old Saturn. (Dr. Steiner says that if the minerals could talk, they would tell you about conditions on Old Saturn. They have, so to speak, an 'Old Saturn consciousness'.) Similarly, the plants have a physical and etheric body, and an 'Old Sun consciousness'. The animals have an astral, etheric and physical body, and a consciousness reminiscent of that possessed by man on the Old Moon. Only man himself has an individual Ego incarnated on the earth.

In another sense, however, the hard, solid, present-day minerals are very much a product of the present stage of evolution. On Old Saturn, Dr. Steiner says, matter did not become material at all in our sense; it condensed from out of a purely spiritual condition into a state he describes as one of finely differentiated warmth. On Old Sun, something like a gaseous state was reached; on the Old Moon, a liquid state; solid substance as we know it now is a product of the Earth evolution. But in speaking of 'gas' and 'liquid' it is important to realize that this is only an analogy. Nowadays, we mean by gas something just as solidly physical as stones and rocks, but very finely dispersed. We must picture the 'gas' of Old Sun, or the 'liquid' of Old Moon as permeated with tremendous spiritual forces, and the entire planet as a vast living being in its own right.

The present earth-evolution began with a kind of recapitulation of the previous stages, and substance itself passed through these earlier conditions. Just as the human being passes through embryonic stages and develops a really hard skeleton only gradually, some years after birth, so the present mineral body of the earth developed gradually through various 'embryo-like' stages, when its substantial condition was quite different from what it is now.

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Rudolf Steiner describes five main evolutionary stages of the earth up to the present. He calls them Polarian, Hyperborean, Lemurian, Atlantean, and Post-Atlantean (our own).

The Polarian epoch began in a way reminiscent of Old Saturn with a kind of condensation from out of the cosmic periphery of a planetary body consisting of 'differentiated heat'. This body contained the present sun, moon, earth, and all the other planets within itself. During the Hyperborean epoch further condensation took place, and gave rise to a body consisting of warmth and light-filled air. At the same time, the outer planets, Saturn, Jupiter and Mars were separated off from the parent body, which still contained the sun, earth, moon, Mercury and Venus. The Hyperborean epoch closed with the separation of the earth - still containing the moon - from the sun.

The Lemurian earth was the scene of a great many events of the utmost significance for mankind. Dr. Steiner's descriptions of this epoch take some getting used to, for the whole aspect of the earth at that time was extremely strange. But, unlike the Polarian and Hyperborean epochs, the Lemurian age is the first which has left direct physical remains which we can study, and is therefore in some ways more accessible to our understanding.

We must imagine the earth at the dawn of the Lemurian age as a huge, egg-shaped, living body, much larger than it is now, consisting of liquid imbued with air and warmth. The densest matter was in a fine colloidal, or 'aerosol' condition. Gradually the centre of the earth began to differentiate from the periphery, and, in particular, heavy metals such as iron and nickel began to condense into the centre. The present heavy metallic core of the earth originates from this time.

On to this inner core a 'rain of silica', in Dr. Steiner's phrase, began to fall, condensing down out of the surrounding warmth-and air-permeated liquid to form the first beginning of the earth's crust.

This kind of sedimentation from out of the fiery, misty, watery, living atmosphere, continued throughout the Lemurian epoch to a greater or lesser extent, and to this process a major part of the geological strata we know today are to be attributed. The pre-Cambrian, Cambrian, Ordovician and Silurian rocks were laid down in the first part of the Lemurian epoch, but it must be borne in mind that they had a quite different consistency - colloidal and 'foamy' at first, then jelly-like, and later more waxy and horny, but still 'alive' to some extent and 'dying' to become minerals as we now know them only at a much later stage.

To an orthodox geologist this whole picture will, of course, sound simply fantastic - but this is largely because scientists have got so used to the assumption that 'laws of nature', and the physical conditions to which they apply, are eternal and immutable. But there is no special evidence to support this metaphysical assumption, and it would clear the way for a much more subtle and dynamic view of evolution if orthodox science would consider the notion that not only plants and animals, but the whole earth, the matter of which it consists, and physical 'laws' themselves, have been subject to evolution. If one looks at a cliff face containing convoluted layers of rock which seem to have been twisted about like plasticine, it becomes almost impossible to believe, as orthodox geology would have it, that ordinary hard rock was slowly bent into such shapes simply by enormous pressures. It is much easier, for the naïve observer at least, to imagine a time when the rocks had a more toffee-like consistency, and the whole surface of the earth was far more active and flexible<sup>3</sup>.

\* \* \*

The strata known as Carboniferous, Permian, and Triassic belong to the middle part of the Lemurian epoch. During this period, according to Rudolf Steiner, an extremely important event occurred - the separation of the moon from the earth. In the part of the earth where the Pacific Ocean now is, a kind of infolding of the earth's crust occurred, and a separate planetary body was formed, which was then ejected to become what is now the moon. Into this body were concentrated all those substances and forces which had tended to make the solidification and hardening processes of the earth go on too fast. The departure of the moon left a huge 'wound' in the earth, and many of the geological revolutions of the period were caused by the whole earth's crust trying to 'grow' over from the western pole of the earth, in order to 'heal' this wound. The whole Pacific basin is today surrounded by mountain ridges which provide evidence of this process, and the constant volcanic activity and colossal chasms which still exist in the floor of the Pacific show that the wound is still not healed.<sup>4</sup>

Through the steady precipitation from the thick colloidal atmosphere, a hot watery earth surface, with islands of denser material floating in it, gradually formed. The core of dense fiery material was constantly breaking through the very thin crust. The atmosphere itself was still extremely heavily laden with water, but was thinning slowly all the time.

The swampy regions of the tropics today are a kind of echo of conditions during the final part of the Lemurian epoch, after the departure of the moon. But one must imagine everything mineral in a more plastic state, temperatures higher, the air still much thicker, and volcanic activity, often on a tremendous scale, going on all the time. Above all, one must remember that all matter was still far more intimately woven through with spiritual forces. The Lemurian epoch ended when the Lemurian continent - roughly on the site of the present Indian Ocean - was destroyed by a fiery volcanic catastrophe, and the principal scene of evolution, as far as mankind was concerned, became Atlantis, where the Atlantic Ocean now is.

The beginning of the Atlantean epoch coincides approximately with the beginning of the Tertiary. During this period the earth's crust gradually became much more solid; volcanic activity diminished, and the atmosphere, though still very watery by our standards, became gradually clearer. During the later phases of the Atlantean epoch parts of the earth began to get much cooler, and the Ice Age drew on. Atlantis itself was destroyed by a water catastrophe and now belongs to the bed of the Atlantic Ocean.

By this time the glaciers which had covered most of northern Europe were receding; the end of the Ice Age marks the transition from the Atlantean to the first post-Atlantean epoch. At last, conditions on the earth had become very like those of today.

This is a very simplified account of a very complicated series of events, but to go into more detail would make this article too long.

The table below is an amplification of the table above.

		Quaternary . . . . .	Post-Atlantean epoch.....	Modern man
			Ice Age	
Cenozoic				
		Tertiary . . . . .	Atlantean epoch .....	Mammals
		Cretaceous		
Mesozoic		Jurassic	. . . . . Late Lemurian epoch.....	Reptiles
		Triassic		
Differentiation and departure of the moon.				

		Permian		
		Carboniferous	. . . Middle Lemurian	
Paleozoic		Devonian		... Fishes
		Silurian		
		Ordovician		
		Cambrian		. . . Early Lemurian
		Pre-Cambrian		

Geology begins

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Condensation as far as air- and warmth-filled liquid . . . .Hyperborean

Condensation as far as warmth-filled air . . . . . .Polarian

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Purely spiritual existence.

\* \* \*

When we look at the huge panorama of geological strata and fossil animals, together with the existing animals we know today, several important questions force themselves on our attention. Why, in the first place, is a distinctive group of vertebrate animals associated with each of these geological divisions (which match at the same time Rudolf Steiner's evolutionary stages)? What is the significance of the 'Age of Fishes', the 'Age of Reptiles', etc.? Why are mammals and birds the dominant vertebrate creatures now (excepting man himself), rather than reptiles or amphibians?

The physical remains of past evolution reflect spiritual and cosmic evolutionary processes which were going on at the same time. The series of fossil animals reflect - but only reflect - the evolutionary processes which prepared a physical body into which the Ego of man could incarnate. How, then, are the spiritual events which took place during the epochs described by Dr. Steiner reflected in the physical events we have been considering? The succession, fish-reptile-mammal-man, is in itself suggestive.

The fish lives suspended in water. It is dependent on the sea for everything - for moving about, eating and breathing; the sea looks after its eggs; its behavior is closely interwoven with things happening around it in the water. The consciousness of fish seems to be spread out in a kind of deep watery dream through the ocean; it has little or no internal soul-life of its own. Fish are united with, given up and abandoned to, their environment.

The reptile breathes air. It has limbs on which it supports itself, and eyelids of a kind, so that it can shut out impressions from the environment. It is still bound up with the environment in many ways - if the weather gets cold, it gets cold too, and many reptiles depend on the sun's warmth to hatch their eggs. But the reptile seems to have an internal life which is more separate from the environment than that of the fish is; there is a new sort of action and reaction between the creature and its surroundings.

If one looks at the fossil skeletons of Mesozoic reptiles, one can read something of the 'character' of the various forms: the fierce carnivores, with predatory jaws and powerful limbs; the huge, placid looking Diplodocus - a reptilian version of the cow; the delicate bird-like flying reptiles, and so on. It is true that primitive fossil fish also may look extremely fierce, or fantastic. But this impression is not derived from the internal skeleton of these animals, about which little is known in many cases, since it was cartilaginous, and has left few fossil traces. The fishes' 'expressions' derive largely from the elaborate external armour of plates of various kinds in which most of these early forms were clad. Here again, one feels that the fish's 'character' is somehow 'impressed' upon it from outside.

The mammal is warm-blooded. It can maintain its own internal world of warmth, which the reptile cannot. It can reproduce its own kind with negligible help from the environment, and, from its larynx, it can give birth to a wealth of new sounds, where the reptile can only produce, at best, mechanical hissings or drummings.

Thus the fish is a water creature; the reptile 'conquers' dry land with its limbs, and air with its lungs. The mammals 'conquer' the element of warmth, and can express their inner experiences to a limited extent in sounds.

\* \* \*

What does this succession of 'water animal', 'air animal', and 'warmth animal' suggest in the light of Rudolf Steiner's teachings?

The watery element may be regarded as a kind of gate through which etheric forces can enter the physical world. Seeds start to grow when they are wetted, and the physical bodies of all living things contain more water than anything else. Similarly, air is in a sense the gateway for astral forces. The air carries the cries of animals which express their pains and pleasures. Our breathing is particularly sensitive to our feelings and passions. The soul-life of the whole planet is expressed in the winds and weather which swirl over the earth's surface. The atmosphere is in a sense the physical expression of the earth's astral body.

The warmth element bears Ego forces into the world. We speak of the 'warmth' of someone's personality. We may also speak of a 'cold fish', where the Ego-hood of a person does not come out into the world properly to meet other people.

I think we should regard the 'Age of Fishes', the 'Age of Reptiles' and the 'Age of Mammals', therefore, as a reflection of the changing and evolving relationship between the physical, etheric, and astral bodies, and the Ego

of man himself. By the dawn of the Lemurian age, a tenuous etheric-physical vesture for man had already evolved, formed in the fiery misty living atmosphere out of which the more solid parts of the earth were gradually condensing. The astral and Ego principles of man were still hovering in a more purely spiritual condition round the earth's periphery. Where this tenuous vesture was taken hold of by beings who were over-eager, so to speak, to unite themselves with the solid earth-element which was beginning to emerge, primitive fish forms began to appear, swimming in the denser parts of the earth's watery, fiery atmosphere (a division between air and water had not yet taken place). In this way, the fish lost the chance of beginning to incorporate astral forces into itself in a more intimate way.

Gradually, something like solid land - but still very plastic and imbued with life-forces - arose, and in the atmosphere a less dense, hot, gaseous, steamy part began to divide from the denser, more watery part. Astral forces were beginning to work down into the body of the earth, and into the physical-etheric vesture of man. The human bodies of that time lived in the thick Lemurian atmosphere, half-floating, half-flying. They would have looked grotesque, as an embryo looks grotesque, and were distinctly reptilian in appearance.

(Dr. Steiner describes the physical body of mid-Lemurian man as looking rather like a 'soft-bodied dragon'.) In the Mesozoic reptile fauna we can trace the expression of beings which seized on the human physical-etheric-astral substance in order to descend at once into material existence, thus creating forms in which they were, so to speak, imprisoned, with no opportunity of evolving further.<sup>5</sup>

There is, however, a further essential aspect of the evolutionary process which must be taken into account (however briefly and inadequately) at this stage. According to Dr. Steiner the departure of the moon in the middle of the Lemurian age: had a definite connection with what we call the 'Fall of Man'. The Fall occurred when certain spiritual beings - the Luciferic beings - entered into man's astral nature and were able to endow it with a certain independence from the higher beings who had previously guided it. Through this, man became the possessor of a wild and fiery astrality which his Ego was too young to control. This astrality-run-wild is reflected right down into the Mesozoic reptiles, with their often terrifying and stormy aspects.<sup>6</sup>

The Luciferic influence had the effect also of drawing man into closer connection with the fiery, or astral, forces of the earth, and thus causing him to 'fall' from the cloud-regions to the earth's surface. The departure of the moon may be regarded as a necessary counter-influence to these events. By reducing the gravity and hardening forces of the earth, it enabled man to take an upright posture, thus freeing his hands for creative work, and also to postpone the hardening of his physical body until it was sufficiently developed to bear the Ego. While mankind was living in physical-etheric-astral form on the volcanic turmoil of Lemuria, where astral forces were running wild, the human Ego was able to hold back, so to speak, and not become involved in physical existence until the beginning of Atlantis. (The volcanic fiery catastrophe which destroyed Lemuria was caused, Dr. Steiner says, by a release of astral forces which man could not control.) Man's adoption of an upright posture is reflected also in the reptiles. During the middle of the Mesozoic, many forms arose which walked or ran on two legs, and stood almost upright. But during the second half of this epoch something particularly interesting happened. On the one hand, the reptiles were gradually overcome again by gravity, and sank back on to four legs - some even took to the water, like the crocodiles. At the same time, some forms seem to have gained a certain freedom from gravity, and various flying, bird-like reptiles, together with the first primitive birds, appear in the fossil record.

By the end of the Mesozoic - which is also the end of the Lemurian - something like the present-day division into dry land, sea and air had taken place, although - compared with any conditions we know today - the land was much softer and wetter, the water much thicker, and the air much waterier. At this point the real task of earth evolution - the gradual descent of the Ego into the physical world - could begin. Gradually, the physical-etheric-astral vehicle for the Ego was made ready to receive it. In the wonderful panorama of fossil animals during the Tertiary period, from the so-called mammal-like reptiles, up to the apes, we see a remote reflection of this process. Remote, because the beings who expressed themselves in the Atlantean-Tertiary mammals had parted from the human evolutionary stream right back in the Mesozoic, and had then renounced the possibility of ever giving full expression to the Ego principle in the physical world. Nevertheless, the warm-blooded animals represent an attempt to incorporate the Ego - but an attempt which had to stop half-way.

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By the end of Atlantean times the human physical vehicle had reached a stage when it could begin to receive the Ego fully into it, and when also it was mineralised enough to leave fossil remains.

(This is a rather simplified picture. In his book, *Der Mensch der Eiszeit und Atlantis*, Sigismund von Gleich traced

the connection between some of the fossil forms of 'primitive man' and the later Atlantean races. But to go into this would need too much space.) However, the picture can be developed a little further from another aspect. As we have seen, the physical, etheric and astral bodies of man began their evolution on Old Saturn, Old Sun, and Old Moon respectively. When the earth evolution began, these principles already existed, in a certain sense, as spiritual 'Ideas'. The first three evolutionary stages of the earth, the Polarian, Hyperborean, and Lemurian, were recapitulations of Old Saturn, Old Sun and Old Moon, necessary in order to adapt the physical, etheric and astral principles of man to earthly conditions, ready to receive the Ego. But a similar recapitulation can be discerned within the Lemurian age itself.

The 'Age of Fishes' is like a memory of Old Sun; the fish, with its consciousness, spread out in its environment, given up to the watery element, is the nearest a vertebrate animal can get to the plant-like consciousness and condition which characterised the stage of evolution reached by man on Old Sun. Similarly, the Age of Reptiles is a recapitulation of Old Moon, in which astral forces come to expression with great force. The Atlantean (or Tertiary) sees the beginning of something new, which belongs to the earth alone.

In this connection it is interesting to observe how all the mammals seem, in a sense, much younger than fishes or reptiles. Reptiles, in particular, seem to bring an almost uncanny recollection of times long, long ago, before man was man at all. Most of them live secret lives in parts of the world, such as the tropical jungles, where man is not welcome or at home. Just as we may look at the plant kingdom as a legacy of Old Sun, so are the reptiles a legacy of Old Moon, as well as of the Lemurian Age.

The animals with which man has most to do on earth today are 'new' animals, so to speak. There are still some 'old' animals about - the reptiles, curious creatures such as the rhinoceros (which while a mammal has a prehistoric air), and various eccentric forms. But we are most familiar with the modern birds, and with herbivorous and carnivorous mammals such as the cows, the cats and dogs. These groups somehow 'belong' to the present age. The special connection of these groups of animals with the present age, the 'Age of Man', is indicated in the figure of the Sphinx, which is at the same time a kind of composite figure of man himself.

The Eagle, the Lion and the Bull are expressions of forces which work in the head, the heart, and the digestion and limbs of man respectively. Now looked at zoologically, so to speak, the Sphinx is curiously lop-sided - the Eagle is a bird, but the Lion and the Bull are both mammals. This implies that man's heart and limbs have something in common which is not shared by the head. I believe a key to this problem lies in the fossil record.

During the Mesozoic a division took place between 'mammal-like' and 'bird-like' reptiles. But while modern mammals, in their whole character, have 'broken' with the reptiles, so to speak, the birds, in an interesting way, have not. A bird is like a reptile in disguise: its feathers make it into a beautiful creature. As it swoops and circles in the air, it seems a creature of light, air and warmth, ignoring gravity completely. But look a bird closely in the face, and one becomes aware of the curious mask-like quality of the head, with its hard and often cruel beak, and unwinking eye. A plucked bird, or an unfledged nestling, has loose, wrinkled skin, reminding us of the skin of an extremely ancient man or woman. Removing the feathers from a bird unveils it as a reptile. A thrush running across a wet lawn betrays its reptile connections immediately: it runs a few twinkling steps, like an agile two-legged lizard, and then stops, with the same uncanny frozen immobility as the lizard - a peculiar immobility of which mammals are incapable. The bird fauna, represented in the Sphinx by the 'king of birds', the Eagle, seems to point back to a distant past, to the 'Age of Reptiles', in fact. Why should this be?

The Eagle represents the head forces in man. (Dr. Steiner described birds as animals which are 'all head'. The legs are insignificant twigs, while the digestive system - compared with that of a cow - is little more than an afterthought.) In another connection, Dr. Steiner has also described the special connection which man's head has with the past. When we return to earth for a new incarnation, we bring what we have experienced through our limbs, and what we have learned through our deeds, back into the world, but transformed and 'summed up' in our head. Every child bears its past life in a metamorphosed form in its head, while in its limbs lie the germs of its future life. Now the bird fauna seems to me a sort of reincarnation of the Mesozoic reptile fauna. It brings over into the earth-evolution proper - into Atlantean and post-Atlantean times - a transformed summary of the physical-astral-etheric nature which expressed itself on Lemuria, and was really a recapitulation of something which developed on Old Moon. The bird is a metamorphosis of an animal form whose great achievement was the development of limbs (the reptile) into an animal which is 'all head'.

In the same way, the Eagle in the Sphinx points us back to our past - to our past life, but also to our whole past evolution. The emergence of the birds reflects the transformation of man's Old Moon nature into its earthly form. In his head, man bears not only the imprint of his past life, but also the imprint of his past as a whole. In his head

he is a metamorphosed denizen of the Old Moon.

(In his rhythmic system, his blood and breathing, on the other hand, he is a citizen of the earth. Through his limbs, he already works towards a future planetary incarnation of the earth, called by Rudolf Steiner the Jupiter incarnation.) The fact that the bird reproduces by means of an egg - that there is a kind of discontinuity in the physical world between mother-bird and offspring - is a hint that the head aspect of man is connected with his past through reincarnation. In the mammalian part of man's nature, that which bears the forces of his present and future life, he is connected with his past through the continuous stream of heredity, expressed in the milk which the young animal draws from its mother.

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The fossil record is taken by orthodox scientists to express purely physical events. But with the help of Dr. Steiner's teachings, these old, stone bones can take on quite new life. They reflect, often in a quite startling way, the great cosmic and spiritual events which Dr. Steiner described in his account of the evolution of the earth and of mankind. There is nothing fortuitous about the huge fossil fauna, or about the animal forms which surround us today. They all have definite parts to play in the scheme of things; every animal 'makes sense'. Sometimes, to our eyes, the aesthetic quality of a creature - a tiny tropical fish, for example - may be more apparent than its usefulness. But it should be possible to 'read' in the forms of all existing and extinct animals an expression of specific spiritual forces, beings, and events. A future 'spiritual zoology' will have to try to do this.

Here I have tried only to trace, broadly and rather sketchily, the way spiritual and physical evolution have intertwined in the animal kingdom - or, rather, in the vertebrates - and the relationship of the animals to man, both in the past and today. It is as a very provisional sketch that this article should be read.

## Footnotes

1. There is evidence of other ice-ages during earlier geological epochs, but in this essay I shall use the term to refer only to the most recent one, which - with warm intervals - occupied most of the Quaternary, and ended about 8,000 B.C.

2. Dr. Steiner says that Mercury and Venus did not separate from the sun until after the latter had separated from the earth.

3. Similar considerations apply to time-scales. According to Dr. Steiner, the Atlantean Age ended, and the post-Atlantean began, about 7200 B.C. This corresponds very well with the end of the Ice Age, in about 8000 B.C. On the other hand, Dr. Steiner puts the middle of the Atlantean Age at something over 15,000 years ago - but the geologists put the middle of the Tertiary at some 15 million years ago. The geologists' calculations, however, are based on the assumption that physical processes have always gone on at the same sort of speed as they do now. But Dr. Steiner says that even the idea of a year is no longer valid earlier than mid-Atlantean times, as it is only since then that the earth has been revolving round the sun at the same speed and in the same orbit as it does today. Thus when geologists put the beginning of the Cambria at some 500 million years ago, this represents an extrapolation of contemporary time-scales back into ages when they do not apply. Before Atlantean times, in fact, it is pointless to think in terms of numbers of years; one has to think purely qualitatively, instead.

4. The departure of the moon was a gradual process. I have not been able to find an exact indication by Dr. Steiner, but it seems likely that the differentiation of the moon-substance began towards the start of the Carboniferous, and that the whole process of separation was complete by the end of the Triassic. The Permian is a mid-point. It is noteworthy that geologists can never quite decide whether to include the Permian in the Paleozoic or the Mesozoic.

5. Dr. Steiner has spoken also of this process from another point of view. The premature descent of these beings into matter was at the same time a sacrifice which made it possible for man to continue his intended evolution. In taking form as the reptiles of Mesozoic age, these beings absorbed into themselves part of the powerful limb- and lung-building forces which were working on man at the time, and might have drawn him down prematurely to walk on the earth and breathe physical air if they had not been partially diverted, as it were, into the reptiles. Similar considerations apply to other animal forms.

6. It is not without significance that the Devil comes to Eve in the Garden of Eden in the guise of a reptile. But I do not think we should picture this Devil as a snake - he did not crawl upon his belly until he was himself cast out of Paradise - but rather as a winged and fiery dragon (and in the Oberufer Paradise Play this is indeed how Lucifer appears). The whole of Mesozoic evolution bears this dragon-like imprint of Lucifer.